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DIETARY SURVEYS AND THEIR INTERPRETATION

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INTRODUCTION

Studies of food consumption are clearly an important feature of nutrition surveys. In fact one of the earliest approaches to an understanding of human nutritional requirements was through studies of the diets of persons in apparent good health. Thus the protein and calorie allowances suggested more than 75 years ago by Voit, the eminent German physiologist, were said to be based upon studies of the intake of laborers on freely chosen diets. Atwater in 1902 (1)1/ proposed dietary standards in terms of protein and calories for adults of varying degrees of muscular activity. These, too, were based to a great extent on studies of the diets of individuals and boarding house groups in different occupations.

Today, even with the more precise laboratory and clinical procedures in use, knowledge of human requirements for many of the essential nutrients is far from complete. Since the state of nutrition (barring pathological conditions) clearly is dependent on previous food intake, its maintenance or improvement in the long run must come from food. Studies of the food consumption of individuals should be part of the appraisal of the nutritional status of individuals. It is important to broaden our understanding of what constitutes "normal" nutritional status and deviations therefrom, to determine the incidence of various deficiencies in the population, and to locate groups whose physical health and nutritional status are exceptional. It is also important to know what levels and patterns of dietary intake are associated with each.

In addition to dietary surveys made among individuals whose nutritional status is being appraised, there also are studies among institutional and family groups, ranging from small spot studies to those of nation-wide dimensions. Data from the latter surveys are of major interest to two groups: (a) those who wish to appraise dietary adequacy in order better to effect improvements in diets, and (b) those who seek to gauge potential markets for selected foods under various circumstances.

Many of the problems involved in the various methods of studying the nutrition of populations were discussed by Bigwood in 1939 (2). This chapter describes some of the more commonly used methods of collecting and analyzing data on food consumption and points out some of the uses of the results as well as some limitations to be observed in interpretation. The first two sections are devoted to a brief description of types of studies that use different methods to secure the original data regarding the kind and quantity of food that individuals or groups consume. Three sections follow which are equally applicable whether individuals or groups are the subject of study. These discuss some points to consider in the collection, analysis and interpretation of data. Two additional sections describe methods of analysis that make family surveys serve many other purposes than appraisal of nutrition. The appendix contains pertinent sections of some of the schedule forms that have been used by different workers in the collection of data. They are included here as illustrations of the methods described rather than as recommendations for use.

1/ Numerals in parentheses refer to literature cited.

TYPES OF FOOD CONSUMPTION DATA

Diets of Individual Persons

Studies of the diets of individuals usually differ from family studies with respect to objective and in the methods used. Interest in individual studies always centers in foods actually eaten (physiological consumption) rather than in both the physiological and the economic aspects of consumption. Information about individual diets and food habits should tie in closely with studies of nutritional status, although the family dietary study can also make an important contribution.

Methods in current use for estimating the consumption of individuals range from a qualitative diet history or food habit inquiry to quantitative laboratory measure of the quantity and composition of the food eaten. Each type of study has its use; the important thing is to consider carefully what kind of facts are needed for a given purpose and which method will provide these facts at the lowest cost.

Dietary History.

This type of study aims to discover the usual food pattern over a relatively long period, as contrasted perhaps with a report of menus followed or quantities of different foods eaten in the previous 24-hours. This method should certainly reveal major deviations from the usual concept of good food habits. It would show up the non-milk drinkers, poor vegetable eaters and the like. As such, it provides some indication of the direction of educational programs to improve nutrition. Even without any calculations of nutrient content, these histories can furnish a basis for classifying individuals into certain broad groups, for example, those whose diets are obviously poor with respect to one or more nutrients, those whose diets probably are better than the average, and an intermediate group.

Some investigators feel that dietary histories can be obtained with sufficient accuracy and completeness to justify calculation into terms of nutrients and appraisal of the individual's dietary practices.

Estimates of Food Eaten Made by the Individual.

In this method the child or other individual is asked to recall what he ate during a previous period, usually the last 24 or 48 hours. Sometimes he is asked for an estimate of the quantity of each food and various aids—pictures, food models, dishes and spoons of different size—are at hand to help in his judgment. This reporting of a day's food may or may not be accompanied by questions about food habits and whether or not this was a typical day. The greatest value of this kind of information is probably its use as a basis for educational or other programs to improve food habits.

Records of Food Eaten Kept by the Individual.

Many investigators have taught individuals to keep an accurate record of all food eaten during a period which may vary from one to seven days or more. Usually an attempt is made to get information on quantity as well as a full description of the food. These quantitative data differ in degree of precision. The quantity of food may be estimated or actually measured, using common measures; or the subjects may be taught to use balances or scales. Many modifications of this method have been developed to fit a particular need.

It is recognized that in this method, as in others, errors may arise at several points. The subject may fail to measure or estimate carefully the quantities of foods eaten or may keep a dishonest record; the analyst may err in translating the subject's quantitative measures or estimates into units employed in the food table used; the food tables may not be applicable in a given case.

However, several findings indicate that the carefully taken individual food record is of value in nutrition surveys. Darby (3) using 7 or 3-day records kept by individuals which included quantitative estimates of foods eaten found that the mean intakes of comparable populations showed close agreement and that the differences which occurred in segments of these populations were in the expected direction. Thus males consistently had a higher intake than females and the calculated ascorbic acid intakes were greater in higher than in lower economic groups [Darby, 1947 (3); Darby et al., 1947 (4)]. Finally, the more labile blood constituents, such as ascorbic acid and carotene, varied between groups in the same direction as the calculated intakes of these factors [Darby et al., 1947 (4)]. A study of the statistical association between food intake of ascorbic acid and its level in the blood has revealed that the association is significant in three nutrition surveys made in quite different population groups [Putnam et al., in press (5)]. Hence, unless one expects too great accuracy from individual records, they seem to permit reasonably good characterization of the dietary habits of groups.

Laboratory Precision in Measurements of Food Eaten.

For many nutrition studies it is important to have precise information on the nutrient intake of individuals. This may mean a record by weight of food eaten in the home or under controlled group feeding, taken by a person trained in quantitative work who is mindful of and alert to possible sources of error. Actual laboratory analysis may be made of a duplicate of a meal eaten or of suitable samples of food. Because of the labor and cost of such studies their use usually is limited to extensive metabolic studies, or to research groups with special facilities for collection and analysis.

All of these methods furnish a certain amount of information about food habits, and give a more or less accurate indication of the probable nutritive value of the diet. There is need for a critical appraisal of the several methods in use in relation to the results obtained and their interpretation and application. Considerable experimental work comparing the usefulness of several methods in connection with surveys of nutritional status has been done but more extensive studies are needed.

Family or Institutional Dietary Surveys

Three general methods are open to the investigator wishing to study diets of families or other groups of individuals sharing common food supplies. They are:

(1) Family food accounts. Simple running reports of food purchased (and produced for household use).

(2) The food record which makes use of a weighed inventory of foods on hand at the beginning and close of the study, together with a day-by-day record (by weight) of food entering the home with or without records of kitchen and plate waste.

(3) The food list, which the interviewer uses in obtaining from the housewife an estimate of the quantities of foods used during the last 7 days.

These methods differ widely in the cost of collecting and analyzing data and in the uses that can be made of the results. In appraising these methods it is taken for granted that well-designed schedules are used as well as procedures adapted to the habits of the group being investigated, and that adequate training is given to field agents or interviewers entrusted with securing the facts. No amount of analysis can compensate for inadequate original data. The unique characteristics of the methods are first described and then certain problems involved in the methods are considered.

Family Food Accounts.

Day-by-day records of food purchases and food expenditures can furnish valuable facts about family food consumption especially among urban groups who keep comparatively little food on hand. This method was used during the war by the U. S. Bureau of the Census as a means of getting quick answers on how consumers were spending their ration points. Many farm families keep such accounts along with records of the food brought into the kitchen from storage or from the farm.

Advantages of this method include its simplicity since it can be easily understood by the homemaker keeping the account, and the relatively low cost of collecting such data. In households with small food inventories, where the diet is fairly monotonous and where food purchasing is pretty much hand-to-mouth, it would be unnecessary to keep food accounts for a long period to get a reliable picture of consumption. In other households, however, food accounts would need to be kept over long periods in order for inventories on hand at the beginning and end of the study to cancel.

Disadvantages include the difficulty of getting a random sample since participants must be willing and able to do the work required. Also interest may lag and participants drop out or become careless in their records to the point of affecting the validity of the results. In addition, the task of summarizing the data is considerable.

Since this methid is not generally used in this country as a means of studying family diets, it will not be discussed further in this chapter.

Food Record Method — Quantitative Measures and Inventories .

The main characteristics of this method are the record by weight of food on hand at the beginning and the end of the period of observation, and the daily entry in the record of the weight of all foods coming into the house for household use. In order to maximize the accuracy of entries the trained field agent or supervisor takes the beginning and closing inventory. An accurate balance is left with the family. The homemaker or some other person is instructed carefully on how to make all entries. A record of menus is secured in order to check the reasonableness of food entries. The field agent visits the household frequently, often once or more times daily, to see that entries are properly made.

Even with daily visits of the field agent some omissions may occur. They may be quite marked in some situations; for example, among farm families a large quantity of the fruit consumed may not come into the house, such as watermelon and apples when these are plentiful in the garden or orchard.

Among the methods of securing food consumption data, the food record rates high in the possibility of securing accurate measures of food consumption for individual families as well as averages for goups of families. It has, however, several serious disadvantages. Repeated visits of the field agent may cause the diet to be altered, even though the family is urged to eat as usual. The agent may in fact unconsciously express disapproval or approval of certain types of menu. Her presence may lead the housewife to put on a good front by serving relatively large amounts of expensive foods or among low-income groups secretly hoping to get material assistance, to deviate in the other direction. So far, no estimate has been made of the frequency or nature of such influences. There is some evidence, however, that families tend to reduce inventory of food on hand at the beginning of the period of observation, since in some surveys closing inventories of food on hand averages less than beginning inventories. There is no evidence, however, that this tendency affects the quality or the cost of the diet.

Perhaps the most important limitation of the food record method is the burden it places on the cooperating household. As a result a relatively high proportion of families drawn in the sample may fail to provide a record. The proportion tends to be higher than average among families where the woman is away at work during the day, the homemaker is over 50 years of age, there is sickness or many small children in the family, or a hired cook in the kitchen. In addition, the burden of the method also decreases the likelihood of families being willing to provide another record later on.

One other disadvantage of the food record method is high cost, both in field collection and later tabulation. The repeated visits of the field agent, the high percentage of the sample failing to cooperate and the need for assembling food quantities from the daily records all contribute to high cost.

Food List Method — Recall

In this method a report is secured from the housewife of the estimated quantity by weight, retail unit, or by household measure, of various foods consumed during the last 7 days. The interviewer uses a schedule covering a complete list of foods. It has an advantage in that only a single and relatively short visit is required. As a result a high proportion of the homemakers contacted are likely to cooperate in reporting consumption, even in a repeat survey. The food consumption pattern is not affected by the continued presence of the field agent. In addition, the cost of this method is relatively low .

Sufficient comparison has not yet been made between the food list and the food record methods to permit definitive conclusions as to their relative accuracy. Such evidence as exists suggests that the food list gives a fairly accurate measure of the food bought or otherwise procured by individual families, though some understatement occurs. The quantity reported may be too small because the person reporting fails to recall that any of a certain food was consumed or that certain uses were made of it. Such omissions are likely to occur even when a carefully designed list is used, and when various techniques are used to help the housewife to recall the kinds and quantities of food used, such as by reviewing menus.

Even when all foods and the specific use of these are recalled, the estimate of quantity given may still be incorrect. However, for this type of error estimates from some families are likely to be too high and some too low, so that for averages for groups of families over-estimates and under-estimates may in large measure be offsetting. Also for an individual family, the over-estimates of some foods may partially offset under-estimates of others so that in terms of various nutrients errors may be less than for individual foods.

Because of low-cost and other advantages the food list method has been used widely in obtaining information on the consumption of separate foods by groups of families, and in providing estimates of the average nutritive value of the food consumed by the groups. With improvement in technique, further comparison of results obtained by the food list and the food record may indicate the food list to be suitable for describing the diets of individual families. In any case, a bridge from the food lists to the food record can be built, if the chief interest lies in approximations of the consumption of population groups.

Economic Versus Physiological Consumption of Foods.

When foods move to the family kitchen whether from market or farm or garden, producers and sellers consider them as having been consumed. Not all of these foods are actually eaten by the family that bought them. Figures on economic consumption in terms of pounds of food, tend to be considerably larger than physiological consumption, because some food may go into the garbage, to pets, may be carried home by servants, or be put to other use. For convenience in the discussion such food will be referred to as "waste."2/

2/ This concept of waste ignores loss of nutrients because of method of cooking or because of failure to use the cooking water. Such losses are considered in relation to composition values to use in calculating nutrients rather than in measuring pounds of food consumed. Estimates of "waste" of food by consumers using a very broad interpretation is presented by W. Kling (6).

In some dietary surveys no information is secured as to waste. The extent to which such waste has been taken into account needs to be noted in interpreting the quantities of nutrients secured in various studies. For example, in the Consumer Purchases Study nonfarm families in the highest food expenditure group report 40 percent more calories than estimated physiological requirement /(7) Table 44/. Since no account was taken of waste, it seems highly probable for many of these families that much of the food available for household consumption was actually not eaten. The data may represent a true picture of economic consumption but not of physiological consumption.

The food records now being used by the Bureau of Human Nutrition and Home Economics call for a daily estimate of food waste, and the food lists call for weekly estimates. Attempts to get a weighed measure of it continue to be made by some investigators. It is hoped that in time facts will be assembled to give a fairly reliable measure of the extent of food waste in the home. Reports from city garbage collectors suggest that from year to year it is highly variable in weight and composition.

How the question of waste is dealt with and what foods are wasted will affect the estimate of the nutritive quality of diets. In this country calorie estimates will be chiefly affected. Considerable fat in plate waste and drippings, and much stale bread go into the garbage. Only a small percentage of American diets are found to be inadequate with respect to calories, however. Calcium, a nutrient often short in diets, is not likely to be affected much, at least for urban families, unless milk goes to pots. For farm families the milk for the family and for chickens has not always been entirely untangled, so food consumption reported in some surveys may overstate calcium consumption.

Facts as to the edible food fed to animals and thrown away as garbage were obtained in a summer survey of a group of families in Georgia. (8) Several diets classified as "satisfactory" before adjustment was made for the food entered in the record but not eaten by the family were classified "unsatisfactory" after such adjustment. Diets of white families of farm owners and tenants who fed their animals larger quantities of milk products than any other food were most seriously affected with respect to calcium and riboflavin. On the other hand, among low-income Negro families of farm sharecroppers and laborers, grain products and fats from the family food supply often went to animals as well as some milk and vegetables. Their diets therefore were lower in food energy value and ascorbic acid than would have been indicated without the facts about food waste.

Total Food Consumption by Family Members.

Both the food record and the food list are especially designed to get facts on food consumption from families who eat most of their meals at home. Usually data are secured on number and type of meals eaten out and the expenditures for these and other foods eaten away from home by members of the family. In appraising the diet for nutritive quality, it is generally assumed that the food eaten out is similar in character and quantity to what was eaten in home meals. Among families where a large percentage of the meals are eaten out, this procedure is questionable, since meals eaten at home may be quite different from those eaten away from home. Further investigation is needed of the interrelation of food eaten at and away from home, and some pilot studies may well be undertaken.

To supplement data secured on food eaten out of the family food supply with a report on the additional quantities and kinds of foods eaten by family members may greatly increase the complexity of the dietary survey. One complication in such investigations is the fact that the housewife who provides the facts on the food eaten out of the family food supply--including lunches taken from home--usually does not know about the other foods consumed even when she knows how much money was sepnt for them. Facts about meals and other food purchased and eaten away from home thus must be secured from the members who consumed it. This may mean extra visits to interview the family members, or giving instructions to the homemaker for obtaining the information from these members. The method used might be that of recalling quantities of various foods eaten during the last day or two, or of keeping an actual record at the time the foods are eaten. Special techniques would be needed to get reasonably accurate estimates of quantity. It would be desirable also, but often impossible, to have data on ingredients in mixed dishes eaten away from home.

While it is perfectly feasible to obtain this information about foods eaten away from home by family members, the data themselves will seldom be as accurate as those on food consumption in the home obtained by the food record method. Furthermore the quantities will be on a different basis, foods "as eaten" rather than "foods as brought into the kitchen" which means special handling in computations and analysis. Nevertheless the increase in the proportion of meals eaten away from home makes this supplement to the family dietary survey increasingly urgent.

Distribution of Food Among the Family Members

A dietary survey that gets facts only on the total quantities of food consumed by families tells nothing about the distribution of foods among family members. Observation suggests that it is not always distributed on the basis of need. Facts about distribution within a family for the most part call for special studies, although it is sometimes feasible in family dietary surveys to get some facts about it along with the usual facts on total family consumption. This has been done, for example, in a dietary survey made by the Bureau of Human Nutrition and Home Economics during 1946 and 1947 in Cumberland, Maryland, of families with school children in the third to the sixth grade. Facts bearing on distribution included menus, recipes and quantity in household measure of each food eaten at home by the children in the third to the sixth grade.

SOME POINTS TO CONSIDER IN COLLECTION, ANALYSIS, AND INTERPRETATION

The sample — Size and Representative Character

The method chosen and the sample needed should be planned in the light of the kind of questions for which answers are sought, the response to be expected from consumers from whom facts are requested, and the funds available for both the field collection and the later processing of the data. The matter of purpose or use of the data is complex because dietary data have multiple uses that develop in part as the potentials of the data collected are recognized.

Many questions are likely to arise. In family studies, for example, it may be important to consider whether the descriptive data needed should cover all housekeeping families. Or whether it might be desirable to concentrate on getting facts and figures designed to measure the effect of difference in income, family size, season, place of residence. If the latter seems best, it may be advisable to limit the types of family included. By getting a more homogeneous group the data will be more suitable for certain types of analysis.

The size of sample needed turns on what classification is to be made in analyzing the data and what foods are in need of special study. The lower the variability in consumption of a given food among families or individuals the smaller is the number of families or persons needed to give stable averages. Because of the wide differences among foods in variability of consumption it will probably never be possible to have samples in family dietary surveys large enough to permit extensive analyses of all foods.

Random samples, in which every consumer or consuming unit has the same chance of being included in the study, are useful for describing the larger universe from which they are drawn. Non-random samples can also be used for this purpose if the distribution of characteristics in the larger universe that have a bearing on food consumption are known and if the non-random sample provides measures of consumption in terms of these. Even when non-random samples cannot be used as a basis of state and national averages for example, they may if carefully used provide very valuable data for a study of the factors affecting food consumption and also of the nutritive value of the diet in relation to the known or estimated needs of the consuming groups.

In order to maximize the usefulness of data secured in surveys, it is highly important that the method of selecting the consuming units be fully described, along with facts as to those consumers drawn in the sample who were unwilling or unable to provide the information requested. Analysis may include a comparison of the characteristics of the sample with those of other samples or censuses. The U. S. Bureau of the Census publishes population characteristics and agricultural data showing many of the items by small geographic units, such as countries and townships. Appraisals of the sample are usually included in reports of surveys, such as those made by the Bureau of Labor Statistics (9) and the Bureau of Human Nutrition and Home Economics (7).

The Time Period to Which the Diet Relates

Two aspects of the time period covered by a dietary survey seem especially important: (a) the difference among seasons, and (b) the day-by-day and week-by-week variability in diet quite apart from seasonal change.

Seasonal Difference

Diets may vary greatly with season even in highly urbanized areas drawing food from many regions. This has been indicated by Stiebeling and Phipard in a study of diets of city workers' families in 1939 (10), and by studies of the Bureau of Labor Statistics (11). Even more variation occurs in rural areas where there is greater dependence on local or home-grown produce. Differences between fall and spring diets in rural Tennessee were shown by Kaser et al., (12). Milam and Darby (13) presented data on food consumption in four seasons in a rural county in North Carolina. In addition, Milam (14) pointed out the seasonal changes in vitamin C blood levels which obviously reflect differences in seasonal intake.

These studies give some basis for gauging the effect of season on the nutritional quality of diets. Relatively little has been done, however, in following a group of families or individuals through the various seasons and getting a measure of the relative adequacy of average diets at different times during the year. In one such study in Czechoslovakia, the consumption of individuals in a farm family was recorded throughout an entire year (15).

The Bureau of Human Nutrition and Home Economics is at the present time comparing data from a small group of families in two seasons in one year so that diets in the two seasons may be compared family by family. A similar study of four families at four seasons was made several years ago.

In planning studies, then, to get an annual or even a complete seasonal picture, the collection of schedules should be spread throughout the year or season. Sometimes, however, it may be desirable to get seasonal extremes for comparative purposes, a sample of schedules then being taken at the height of each season. In any case, careful attention must be given to timing and selection of families or individuals in order suitably to diffuse other factors likely to affect consumption.

Day-by-Day and Week-by-Week Variability

If it should be determined that every day or every meal should carry a balance among certain nutrients, then it is important to get day-by-day reports. If it is sufficient, however, to have the diet adequate over a period of a week or longer, then the question is how long a period should the data cover in order to be sure that the average consumption per day or per week is a measure of customary behavior within a given season. In some societies the food may be so monotonous that a report covering a day or perhaps two at the most along with feast periods coming a few times a year may give a reasonably complete story. In the United States, however, a weekly pattern of food consumption is quite pronounced. As a result a period of at least a week is felt to be desirable to get a measure of the percentage of families having diets of a given nutritive quality.

It should be recognized that in any distribution of families or individuals by level of nutrient intake there will be fewer cases in the extremes when the data are based on 7 days than on 1 or 2 days. In other words, there will appear to be fewer inadequate diets when the longer period is used.

The question is sometimes raised as to whether a period beyond 7 days is needed (16) and if so, what is the best method to use in collecting data.

In a second week cooperation with a family food record would probably be low. A food list covering the past two weeks rather than the past week might result in too low a level of accuracy. It might be feasible to get families to cooperate in giving a 7-day food list for two successive weeks or for two weeks not too far apart. In making such a test it would seem best to keep the weeks within a season.

Nutrients in Diets

What Nutrients to Measure.

The first question to decide in planning the analyses of any diet record for individuals or for families is which to include of the 40 or so nutrients needed by the body. Some nutrients are so widely distributed among foods or are sufficiently closely associated with others that not all need be considered in equal detail. Which should be considered will depend to a large extent on the nature of the diet. If the nutritive content of diets is to be caluclated rather than analyzed, the availability of suitable food composition data must be considered. The investigation should consider also the yardstick to be used in interpreting the nutrient content of the diet. It may not seem worthwhile to calculate the quantities of a given nutrient for which no standards of intake have been proposed. On the other hand, such caluclations will show the relative importance of selected foods or food groups as a practical source of the nutrient in question.

Whether or not it is desirable to calculate a given nutrient in a diet depends on whether or not it is likely to be deficient and on the intercorrelation of nutrients. For example, many studies have shown that it is safe to assume that if calcium and protein are adequately supplied, phosphorus also will be provided in sufficient quantity. However, although calories might never be low in a group being studied, it may be of interest to calculate the energy value of diets because of the relationship between energy metabolism or carbohydrate intake and the requirement for thiamine and other B-vitamins.

The intercorrelation of nutrients in diets is a subject which warrants further exploration. Any feasible reduction in the number of nutrients for which calculations are needed will aid in cutting the cost of analysis. It should be realized, however, that the omission of some nutrients may limit the possibilities for re-interpretation in the light of additional knowledge of interrelationships among nutrients.

Calculated vs. Analyzed Values.

Several investigators have compared the results obtained by computations and by analysis of representative samples of the diets being studied. Recognizing that there might be discrepancies, they wished to know how large they are and in what direction.

Results have led some workers to feel that agreement is remarkably good. For example, comparisons of the mean analyzed caloric value of individual diets with those calculated from modern food tables reveal that despite differences between corresponding individual pairs, calculated and determined means may differ by less than 10 percent. The agreement becomes better when the number of meals included is 20 or more, and when the intakes are measured on the raw basis [Kaser et al., (12); Patterson and McHenry (17); Hummel et al.,(18)]. The calculated and determined means of protein in diets also show good agreement, usually within 5 percent [Patterson and McHenry (17); Widdowson and McCance (19), Hummel et al.,(18)]. Calculated values for fats in the diets generally tend to be higher than the values obtained by analysis [Patterson and McHenry (17); Hummel et al.,(18)].

As to minerals, the reports of Widdowson and McCance (19) and of Hummel et al.(18) indicate that the calculated means of potassium are in excellent agreement with the analyzed means. The British workers also obtained good agreement for phosphorus, while according to Hummel et al.(18) the calculated amount of phosphorus exceeds the determined mean of the diet by 17 percent. The use of calculations for determining the calcium and iron content of diets is somewhat more problematical. Semmons and McHenry (20) found for their 21 meals that the calculated means tend to exceed the determined means. This same tendency was observed by Gutman and Low (20) and Hummel and co-workers (18). On the other hand, Widdowson and McCance (19) found the opposite tendency, the analyzed values tending to be higher than the calculated. They attributed the discrepancy to the hard water used for cooking. When soft or distilled water was used for cooking, they obtained good agreement. According to them, the daily intake of calcium from water averages 75 mg. in England and may go up to 200 mg., depending upon the "hardness" of water. Actual intake of iron may exceed the calculated amount in the diets due to contamination during the process of food preparation, or due to differences in locality [Widdowson and McCance (19), Kaucher et al.,(22)]. Kaucher and others reported the calculated to be approximately two thirds of the actual intake in an iron-rich locality. On the other hand, for the 21 meals analyzed by Young and McHenry (23), the calculated content exceeded the actual mean content of 6.3 mg. by a difference of 0.6 $\pm$ 3.1 mg.

Perhaps the greatest discrepancies have been found and are to be expected in vitamin values because of wide natural variations and chance for loss in the handling of foods. Calculated ascorbic acid intakes are likely to exceed the actual determined values, particularly if the food tables employed are based upon uncooked foods [Young and McHenry (24) Kaser et al., (12)]. When proper allowances for cooking loss are made and the means of a week's meals compared, the agreement between calculated values and determined values is brought within chance error, particularly when population groups are considered [Kaser et al.,(12)]. Comparisons between the calculated and determined values of mixed diets for vitamin A, thiamine, riboflavin, and niacin indicate that despite marked discrepancies which are sometimes found between the values for individual diets, the mean calculated figures may yield useful information for classifying a population into broad levels of intake.

When methods of analysis improve and more data are obtained on the effect of processing on vitamin content of foods, so that tables of the average composition of foods as served are available, the calculated values may agree more closely with the actual intake, and become more useful.

In conclusion, it appears reasonable to agree with Widdowson and McCance (19) that "The results are considered to be sufficiently close to warrant the use of food tables in dietary surveys." This presupposes that the food intake is accurately measured, the length of period of study is sufficiently long, and proper food tables are applied. A food table is only valid for dietaries where the foods are similar in composition to, and are at the same stage of processing as, those from which the tables are derived. When nutrient values based on raw foods are used in calculation, the results should not be expected to agree with an analysis of foods as eaten, cooked or otherwise prepared.

Information on Food Values.

Carefully prepared and properly used tables of food composition are important in describing the nutritional quality of food supplies. Basic food composition values for calculating nutrients in foods as they come into the kitchen are available in a publication prepared in 1945 by the Bureau of Human Nutrition and Home Economics in cooperation with the National Research Council (25). Other sources of information exist and are used by some investigators in this country. Among the more commonly used sources are the tables of Bowes and Church (26), Taylor (27), Bradley (28), and Sherman (29). Values in the various tables are not always the same.

In other countries average composition figures for many foods are quite different from those used here. Some of the differences reflect real variations in the foods themselves. Others result from differences in methods of calculation from analytical data. For example, in the food tables commonly used in Great Britain figures for carbohydrates represent what is reckoned as available to the body for food energy. In the United States tables, total carbohydrates (by difference) is presented. As a result, quite different calorie values for a given food may be used in the two countries. These differences become of great practical importance in international programs involving calculations of food supplies and food requirements in terms of calories. The bases for computing calorie values were thoroughly reviewed by a committee convened in February 1947 by the Food and Agriculture Organization of the United Nations; suggestions were made as to the most satisfactory procedure for present-day use (30).

Variability in Food Values.

In deriving the average values presented in U. S. Department of Agriculture Misc. Pub. 572 the objective was to obtain representative figures for foods as used in this country the year around. Some of the averages in these tables rest on a large body of data and can be considered fairly stable. Others cannot be as well established until more analytical work is done.

Great variability exists in the nutrient content of foods, particularly for minerals and vitamins. Variety, soil, weather, and other cultural conditions, and length and kind of storage are among the factors affecting the quantity of a nutrient in a given kind of food. Processing and methods of household preparation for eating exert still further influence. For some foods sufficient data are available for a study of the effects of some of these factors, and to provide separate averages for a specified type of condition. Take, for example, the vitamin C content of potatoes, an important item in diet calculations. In deriving the average value, 17 mg. per 100 gm. given in Misc. Pub. 572, over 1,100 analyses were examined. Individual samples ranged from as low as 4 mg. to as high as 40 mg. Data were available for studying losses in storage for varying periods. Thus the mean value for freshly dug potatoes was 24 mg. while for those stored 5 to 6 months it was 10 mg. per 100 gms. The development of a single figure for general use became a matter of appropriate weighting of values for fresh and stored potatoes of the important commercial varieties.

Nutrient losses due to cooking and other food preparation practices have been studied extensively in recent years. Enough is known to permit some rough adjustments to be made in dietary calculations to allow for these losses. However, the large number of variables to be taken into account and lack of information about food practices in the home are reasons why more precise allowances cannot as yet be made in calculating diets. When dealing with family food supplies, it may be desirable to compute the nutritive value with and without this adjustment. This permits comparison with other studies and easy revision as better information on the effects of food preparation becomes available.

When estimating the nutritive value of an individual's diet, food consumption data usually are in terms of food as eaten. Nutrient losses must then be taken into account in preparing the food tables to be used in calculation.

A question that faces every investigator is what, if any, adaptations of general food composition tables should be made for a particular study. In line with the objective of using the most representative figures for the diets being studied certain refinements are possible, particularly where studies are seasonal, local, and comparatively small. It might even be desirable to have special laboratory analysis of locally produced foods important in the diet of the group. The use of special values may be more important for diets of farm than those of city families whose food supply in large part comes from diverse sections of the country. For example, values for raw instead of for pasteurized milk might be used in calculating farm diets. Season probably has a greater effect on the nutritive value of farm than of city diets. Different values for vitamin A in summer and winter home-produced butter might be used. In the late winter or spring months, the average length of storage of potatoes eaten by farm families is much greater than that of potatoes eaten by urban families.

With each dietary study, the investigator wishes to use the most up-to-date and suitable food values. Food composition tables are revised frequently as more and more knowledge becomes available. But this frequently means that results of current and earlier studies are not directly comparable without recalculation. This underlines the importance of reporting in detail the quantities of food consumed. Recalculations can then be made as desired. It is important too that the factors used in calculating nutrients be included in the report or that reference be made to them if they are in a published table. Some estimates can then be made of the differences introduced by the use of specified nutrient values.

Nutritive Value of Mixed Dishes

One source of error in dietary calculations is in estimating the nutritive value of mixed dishes. This problem is of special importance in the menu method of inquiry in which an individual estimates the quantity of each food eaten at a meal. It is almost impossible for him to know the kinds and quantities of ingredients in mixed dishes served at home and especially in public eating places.

In the family food record method, the housewife can supply the recipe for any mixed dishes on hand in the beginning or ending inventory and the ingredients can be figured with the household supplies. Estimates must still be made for mixtures which are purchased, such as baked goods, canned stews and soup mixtures, chicken and noodles, meat and bean combinations, and an ever increasing assortment of other food products. There is no standardization of preparation of these foods and the development of suitable food composition values presents a real problem.

Use of Group Values

Short-cut methods of calculating diets using weighted values for groups of foods closely related in nutritive value, have been reported by several workers(31), (32), (33), (34). Such a method has been used for over 15 years in the Bureau of Human Nutrition and Home Economics in the development of plans for adequate diets. Any technique which reduces the number of calculations saves time and cuts costs and should, therefore, be considered as a possibility.

The total amount of time saved depends on the number of diet records to be calculated. It is assumed that the results are to be studied, diet by diet, and not combined to give group averages only. Otherwise there would be little or no economy in a short method.

The development of appropriate group values requires preliminary study of the food consumption data in order to derive suitable weightings for the items combined into groups. In general, the larger the number of groups the more homogeneous the foods in each group can be, and the better the agreement between long and short methods. Also, the more days represented by the average consumption figures the closer the results obtained by the long and short method will be.

Group values developed in one study for use in one locality or in one season may not carry over to another and frequent testing against the more detailed item calculations is necessary. About 20 years ago the Bureau of Human Nutrition and Home Economics developed a short-cut method of calculating food energy, protein and 3 minerals in family diets [Hawley (35)]. The method was tested out on 121 dietaries (24 from institutions, 47 from farm families and 50 from other families). In every case the short-cut method gave figures for food energy within 5 percent of the long method; for the 4 nutrients 85 percent were within 5 percent. However, when these group values were applied to 116 low-income dietaries from New York City, and compared against the long method, agreement was much less good. For example, in the calculations for iron 47 percent of the dietaries deviated by more than 5 percent from results with the long method, with individual dietaries ranging from 25 percent below to 55 percent above the values obtained by the long method. (unpublished)

On the other hand, Donelson and Leichsenring (32) reported several comparisons which showed excellent agreement, especially when means of groups were compared. Such good agreement can be expected only when food habits among the subjects are fairly homogeneous, i. e., when the proportion of specific foods selected within the food groups are similar, and when the food group values are carefully prepared.

Yardsticks of Adequacy and the Appraisal of Diets

Some Yardsticks of Dietary Adequacy.

When quantities of food are translated into nutrients some yardstick is helpful for assessing the adequacy of these quantities for the people who consume the food. The standard selected may vary all the way from the minimum to prevent deficiency diseases to the amount needed to promote optimal nutrition. The so-called London Standard (36) drawn up in 1935-36 by the League of Nations Technical Commission on Nutrition, represented the first attempt at international collaboration on dietary standards other than for calories. These standards are still used as a yardstick in many countries. But some other countries have developed different standards which they consider more applicable. In the absence of any generally agreed-upon standards many investigators have developed their own yardstick, or adopted one used by others. For example, the dietary standards developed by Stiebeling and Phipard (10) in 1939 were subsequently used by many other workers. A review of the evolution of dietary standards by Leitch was published in 1942 (37).

In this country the recommended dietary allowances of the National Research Council first issued in 1941 (38) have served a useful purpose in providing a (single) yardstick which most workers in the United States have been glad to use. The objective and the bases underlying these allowances have been clearly set forth. They are intended as a guide in planning adequate diets for individuals or families. This means they were set high enough to provide adequately for the many persons with greater than average need. They may represent an unduly liberal margin in planning food supplies for large population groups in which the needs of part of the population are somewhat below the average and part above.

The value of a yardstick is contingent upon its proper use. Its changing character as a result of further research into nutritional needs should be recognized. Diets appraized with the yardstick of 1941 would need to be reappraised to make them comparable with diets appraised using the Recommended Dietary Allowances as revised in 1945 (39). While it is entirely correct to say that a diet or food supply provides the recommended allowances of nutrients for which quantitative suggestions have been specified, it does not necessarily follow that a diet which is calculated to provide these recommended allowances can be called "adequate." For one thing, not all the nutrients known to be needed in human nutrition have been included in the calculations. The allowances have been designed to apply to an average mixed diet such as is commonly eaten in this country. With any great deviation in the type of diet the recommended allowances may not apply. Furthermore, it is sometimes forgotten that the National Research Council allowances represent nutrients ingested and that most tables on food composition in common use in this country for dietary calculations refer to uncooked food as brought into the kitchen.

Recommended dietary allowances, like food composition data, are subject to revision from time to time as knowledge of human requirements unfolds. In any case, they can serve as additional means of description, and results expressed in terms of a standard should not replace the more basic data—the quantities of various kinds of foods consumed or available for consumption, and quantities of nutrients provided by the food. All too often the results of dietary studies are reported only in terms of the percentage of some standard of adequacy. Thus, they are tied to a measure which is itself subject to revision.

On the other hand, tables showing the distribution of diets according to the level of nutrient content, have permanent value in that they can be interpreted in the light of any yardstick—present or future, in so far as the food composition values on which they are based have not undergone major revisions.

Measures of Nutritional Needs of the Consumers in Dietary Surveys

Computations of the nutritive value of a diet are expressed in terms of some unit. When diets of individuals are studied this is not a problem since homogeneous groupings can be made and results expressed per individual. For family studies, however, averages per family per week may be compared directly only if the composition and requirements of the groups of families can be adequately described, and are homogeneous except for not more than one important variable. Averages per person per day are often used and are easily understood. The usual procedure is to divide aggregate consumption for the week (or other period) by the number of meal-equivalent persons (21 meals = one person for one week) in the household. The per capita unit is generally satisfactory for comparing large numbers of families or homogeneous groups. It is not satisfactory for use in evaluating the diet of a given family nor for comparing diets of families of widely varying composition or activity.

To help in estimating the nutritional need of the individuals or families being studied certain pertinent data are usually obtained. These include age, sex, height and weight and may include information as to pregnancy and lactation. Sometimes an estimate of muscular activity is made. When the more accurate family food record method is being used, it is customary, in studies of this Bureau to get information from which to gauge relative activity. It should be pointed out that requirements for food energy for an individual are very difficult to judge and even the most careful estimates based on description secured from individuals may be far from the actual need. Nevertheless, a procedure taking activity, age, height and weight into account is superior to that of assigning an arbitrarily predetermined value to food-energy standards.

When families differ widely in composition and occupation, it is more satisfactory to estimate household size in terms of "nutrition units." [Stiebeling and Phipard (10)]. The "nutrition unit," with a value of 1.00 is usually assigned arbitrarily to the allowance of each nutrient recommended for a man who for size and activity requires about 3,000 calories daily. The values assigned to other individuals represent the relation that their allowance bears to the allowance for this man. Such scales, one

for each nutrient, can be developed from the recommended allowances of the National Research Council. Household size is computed in terms of the number of energy-units, calcium units and so on, to fit the composition and energy needs of the family.

The following illustration for a specified family may serve to explain the calculation of household size in terms of energy and calcium units:

Persons	Recommended 1/ Allowance		Nutrition units	
	Food energy	Calcium	Food energy	Calcium
	cal.	gm.		
Man, physically active	3,000	1.0	1.00	1.0
Woman, sedentary	2,100	1.0	.70	1.0
Boy, aged 13	3,200	1.4	1.07	1.4
Girl, aged 9	2,000	1.0	.67	1.0
Household size in nutrition units	-	-	3.44	4.4

1/ Recommended Allowances of the National Research Council, revised 1948(40).

The effect of changing the recommended allowances for the adult man taken as unity should be clearly understood. For example, the previous allowance (1945) of 0.8 gm. of calcium for adults would have meant that the family listed above was equivalent to 5.0 calcium units instead of 4.4 units. The computation follows:

	gm.	units
Man	0.8	1.00
Woman	.8	1.00
Boy	1.4	1.75
Girl	1.0	1.25
		5.00

The calcium content of this family's diet would calculate to be higher per nutrition unit when the value of unity was 1.0 gm. than when it was 0.8 gm. This illustration indicates the problems that may arise in comparing different studies when calculations of nutrient content are expressed in terms of nutrition units. They are only comparable when the scales of relatives have not changed.

One other problem confronts the analyst in determining whether the family food supply will provide the kind and amount of nutrients needed by the family group. Little is known (as a rule) about how the food is shared by persons in the household. To get this information adds considerably to the labor and cost of the survey. McHenry (41) in a study in Canada, found that the wage-earner had first choice, or at least came closest to meeting his calculated requirements, the young children next, then the older children, and the housewife. These families were all in a low-income group, but even among the relatively well-to-do, individual food habits and idiosyncrasies can bring about an unequitable distribution of household food supplies. This aspect of family studies needs further investigation.

Using a Yardstick to Appraise Diets

Having selected a given yardstick to appraise diets, one must also decide what point or points along its range are to be accepted as providing diets of a given quality, perhaps to be described as good, fair, and poor, or as satisfactory and unsatisfactory.

Some investigators report the proportion of diets that provides (or fails to provide) the recommended allowances (NRC) for each nutrient. Others report also the proportion that provides or fails to provide some fraction—70 percent, two thirds, one half or other proportion—of these allowances. The important thing is to define what is used and to regard this appraisal as an additional but not basic feature of dietary analysis.

Diets classified as unsatisfactory or poor are usually so designated if they fall below the dividing line in even one nutrient. Some workers have felt that a diet low in one nutrient should not be in the same category as a diet low in several or all nutrients studied. Accordingly, several attempts have been made to develop a composite valuation which would give suitable weight to the several nutrients being studied. Some workers have computed the percentage of some standard allowance of each nutrient and have combined the several percentages into an average, either simple or weighted. In some cases more weight is given to the nutrients most likely to be low in the diets.

Dietary Studies in Investigations of Nutritional Status

The ultimate test of the adequacy of diets is the long-term nutritional health of the people consuming them. Many nutrition surveys have been conducted in recent years and with the development of more rapid and more reliable methods such studies are expected to increase. A diet history as well as a record of the individual's current food consumption should be a part of the nutrition survey. Often the food record covers only a short period, from one to three days, and may represent varying degrees of accuracy.

The kind of correlation to be expected between dietary intakes and biochemical and other clinical findings has been the subject of much discussion. Lack of correlation between dietary intake and clinical condition may mean inadequate data, including errors in estimates of quantities of foods consumed and composition values of them; it may mean wrong interpretation of dietary or clinical data or both.

Some of the points to be borne in mind in such a comparison include the following: (a) The state of nutritional health at any one time represents the cumulative effect of food consumption over a long period as well as the recent intake of certain nutrients. The diet record may apply to a day or two, or a week. The great variation in an individual's diet from day to day and from week to week may invalidate attempts to closely correlate the two. However, some nutrients, such as ascorbic acid, are not stored in quantities sufficient to carry an individual through long periods of deprivation. In order that blood levels be maintained at their highest concentration, the frequent ingestion of ascorbic acid is necessary. Consequently tests for ascorbic acid levels in the blood may appear to give better correlation with the current diet record than is found in some other measures of nutritional status. Vitamin A, on the other hand, may be stored in quantities sufficient to maintain high blood levels for long periods of deprivation and, hence, very little correlation may be found between recent intake and serum concentrations of this factor. Furthermore, signs of vitamin A deficiency may not be seen in individuals with temporarily low dietary intakes of this nutrient.

(b) The errors that may be introduced by applying tables of average food values to an individual's diet for a short period have already been indicated. These errors are magnified greatly if values for foods as they enter the kitchen are applied to foods as eaten. Perhaps even larger errors are inherent in the method of obtaining food consumption data from individuals.

(c) Only within broad limits can a judgment be made as to the adequacy of a calculated or determined dietary intake for a given individual. Wide individual differences in requirements are known to exist and in fact they may vary from time to time in the same individual.

Estimating food energy needs for subjects of dietary studies is particularly difficult. Since the requirements for some of the vitamins are related to energy metabolism, this may help to explain why evidence of vitamin deficiency does not appear in some cases where intake is apparently very low.

For these and other reasons one should not expect complete correlation between dietary intake for a short period and clinical or laboratory findings for an individual. For groups of persons, on the other hand, and for certain nutrients or aspects of nutrition, results may show fairly good agreement.

There is need for more surveys in which information about diets is secured along with facts about the state of nutrition. It is especially important that some of these be long-time studies, providing periodic checks on the same persons, if we are to enlarge our understanding of the relation of diet to nutritional health as measured by nutrition surveys.

SOME ADDITIONAL NOTES ON ANALYSIS OF FAMILY DIETARY SURVEYS

Analysis as it relates to methodology affecting the basic facts secured has already been considered. In this section attention is focused on the quantitative measurement of the relation of various factors to food consumption and dietary adequacy.

In planning the analysis of family dietary data, the analyst needs a broad knowledge of the behavior of families under a wide range of circumstances. In addition, he needs experience in working with the data. Only when these two qualifications are combined in an analyst are the necessary analyses likely to be designed that will peel off, as it were, and measure the effect of one factor after another.

The questions being asked the analyst of data of dietary surveys are many, even when one limits the list to those relating to actual and proposed food consumption programs. Considerable progress has already been made, especially as to factors causing differences among families at a given point of time. Less has been done in studying the effect through time of various types of change. The former will be referred to as static and the latter as dynamic analysis. 3/

To the extent that sample size permits, data from dietary surveys have in very large measures been analyzed with respect to the following factors: Place of residence, especially farm and nonfarm groups and with some attention to size of city, food expenditure, income, family size and type, occupation of family members, extent of home-produced foods. To a lesser extent the response of consumers to relative prices of foods and changes in these and of food prices in relation to those of other consumer goods has been studied. At the present time there is need for further refinement of the analysis of most factors with special attention to discovering what uniformity if any exists from place to place among families at any point of time and from time to time in a given society. There is also need to compare the results of static and dynamic analysis, especially for such things as income, relative prices and farm-nonfarm differences.

Because much attention has been given to the importance of income, the need for refinement in the analysis with respect to it seems great. There has, for example, been a tendency on the part of some persons when families are classified by income to ignore differences in family size. In addition, some persons have assumed that the measure of food consumption and dietary adequacy in relation to income as derived from a single study provides a true measure of elasticity of demand in relation to income—that is, the response of consumers to a change of income. Definitive analyses have yet to be made.

3/ This discussion is concerned only with the analysis of data from dietary surveys. Single surveys throw no light on the strength of food habits and the nature of attitudes to foods. However, important facts as to diet patterns are secured especially from family food records that include menus and from surveys of individual food consumption. Those interested in the importance of food habits and how to investigate them should consult bulletin of the National Research Council No. 111, "Manual for the Study of Food Habits," a report of the Committee on Food Habits.

The need for further refinement in the static type of analysis exists largely because of the multiplicity of factors involved. In measuring the effect of any one factor, complications are often encountered because other factors are not held constant. There are many correlations among the important factors affecting food consumption. For example, when families in the United States as a whole are classified by income, one finds within each income class variations in the size and composition of the families, in the percentage of families living in the various regions and in the percentage of them living on farms, in villages and in large cities (9) (42). The Consumer Purchases Study provided the largest sample ever secured in a dietary survey in the United States. Its potential for analytical purposes is still far from exhausted. However, even it does not permit complete analysis of the food consumption of groups of homogeneous families classified by season, type of community, region and income.

In the analysis of data from dietary surveys, a major question is how far to sacrifice homogeneity of groups of families in each category in order to get larger numbers per category. It is probable that much can be done in isolating and measuring the effect of separate factors by using smaller and more homogeneous categories than have commonly been used and at the same time depending on the use of the entire sample in regression analysis to indicate the nature of the effect, rather than aiming to get averages for each cell that reflect the true facts of matters being investigated. In addition, insufficient use seems to have been made of multiple correlation. For the latter to be important, short cut methods need to be developed in order to minimize the cost of calculation.

While it is not possible here to review all aspects of the analysis of dietary data that have an important bearing on their interpretation, some of the broad questions as well as some of the analytical techniques have already been considered and in the discussion that follows, problems of classification with respect to family size and composition, expenditures and income will be considered. These are major factors that lend themselves to statistical measurement within various non-quantitative groupings such as farm or nonfarm residence and occupation. In addition, some analytical problems relating to income and home-produced food are considered, as well as the problem of the statistical investigation of dietary patterns.

Variation in Family Size and Composition

Diversity in the size and composition of families has always been a problem in consumption studies. The simplest method is to ignore the sex, age, and physical activity and count only persons, preferably on a week-equivalent-basis. Families might, for example, be classified into perhaps six family size groups and within each family size classified again by income. When that is done, the distribution by composition of family differs markedly from one size of income to another, but to a much smaller extent at the different income levels for a given family size (9).

If the sample is too small to permit the double classification by both family size and income, income and consumption averages per family at the various levels of family income can be reduced to averages per head. These averages are likely to give a somewhat more consistent picture than do the family averages, of the differences that occur if income were the only factor that differed among the categories. This is especially true of urban families, since for these a considerable increase occurs in number of persons per family at successively higher family incomes. However, deflation on a per-head basis tends to understate the difference in consumption that occurs with difference in income among families of a given size and composition.

In the analysis, for example, of dietary data in the light of the provisions of a proposed national food allotment bill, it was desirable to classify families by per capita income. When that was done, the large families which on the average have a high proportion of young children and have the maximum advantage of economies in consumption that come with the larger group tended to fall in the lower income categories. Small families on the other hand, tend to fall in the higher income categories. The measure of elasticity of demand for many foods in relation to income derived by such analysis has a greater magnitude than if averages per head are derived after classifying the entire assortment of families by family income, or if the families are first sorted by size and measures of income elasticity derived for each size of family.

Consumption and Expenditure Scales

The obvious differences in consumption needs of various family members early led to the development of consumption scales and the measurement of family size in terms of standard units (43). These are of two quite different types. For example, family size has been measured in terms of nutrition units in order to appraise the nutritive quality of diets. These have already been discussed (see p. 16). In addition, scales to measure the cost of providing equivalent consumption for the various family members have been developed for separate foods and services and for total consumption. Only two of these are considered here, namely, food expenditure or value and total expenditure scales. The former have been used to reduce the heterogeneity of family size and composition when the effect of expenditures for, or value of, food consumed are being investigated and the latter have been similarly used for family expenditures or income.

If they serve the objective in mind, the value of such scales to measure the relative cost of food for different persons is very great. Scales so far developed, however, treat size of family solely as the sum of separate individuals, taking no account of their groupings into families. There seems little doubt that there are certain money economies with larger size of family. While this economy is much more pronounced for total consumption than for food, since housing included in total consumption is a major category of consumption which increases little with family size, even for food there are economies with larger size of family, and measures built up solely from scales of the separate individuals do not take this into account. This fact is indicated by the data given in table 1. The larger the family, the higher the percentage of families having good and fair diets and the lower the percentage with the poor diet at a given level of food expenditures per unit.

It may be possible to develop additional sets of food-expenditure scales that take into account the relative need of individuals separately and in various family combinations. Consumption units derived from scales for individuals as used at present are probably better for many purposes than per capita measures. The data in table I suggest that the expenditure scales used credit the large family with somewhat more units than it should have on a strictly equivalent basis, yet per capita measures would give them even more.

Table I—Percentage of families of specified types in villages and small cities having diets graded good (or fair) at various levels of expenditures per food-expenditure unit 1/

Expenditure level per unit per week and region	Family types 2/			
	1	2 and 3	4	5, 6 and 7
$1.38 to $2.07				
North and West	16	25	28	30
South	30	32	21	41
$2.08 to $2.76				
North and West	57	71	62	70
South	56	62	85	75
$2.77 to $3.45				
North and West	86	89	89	90
South	84	85	89	88

1/ See Miscellaneous Publication 452, p.57(7). The higher expenditure levels were excluded because almost all families had good or fair diets.

2/ The family types (7), p.16 are as follows:

Type 1	Husband and wife only.
Types 2 and 3	Husband, wife and one or two children under 15 years
Type 4	Husband, wife, at least one child 16 years or over, and one or more of any age.
Types 5 to 7	Husband, wife, and with at least two children under 16 years and some other children

Relation of Family Size and Food Consumption

Using data from the Consumer Purchases Study and to a lesser extent those from other studies two types of questions have been investigated: (1) At what income level does each family size achieve a specified quality of diets? (2) How does the quantity of food consumed or food expenditures differ according to the family size when income is held constant?

Data with a dual classification by income and family size or type permit preliminary answers to these questions. For example, it has been found, using data from the Consumer Purchases Study, that among families of two or more that the size of income needed to yield the same percentage of families with good and fair diets for families of different sizes could be expressed by the following formula:

$$\text{Log } y = a + 0.62 \log x$$

where y is the amount of the income and x is the number of persons in the family (44). This measure takes into account family composition as it tends to be correlated with family size in a given urban society.

The change in food expenditures with family size while income is held constant has been studied by many. Published data are available for the development of such a measure of the effect of family size alone. When plotted on double logarithmic scales, these show linear relations of family size and food expenditures (45).

Even though considerable advance has been made in untangling the interrelations of family size and type, income and food expenditures there is still need for samples of families large enough to permit the analysis of one homogeneous family type at a time in relation to other facts. It may be that as data from various surveys accumulate, they can be pooled to permit more effective measurement of differences from one type of family to another.

Current Versus Income for a Longer Period

A dietary study usually covers food consumption for only a short period of time, often a week. The income reported often is that of the preceding year if the survey includes farm families and the preceding month for urban wage earners. Because incomes of families, especially in certain occupational groups, fluctuate a good deal, the question is frequently asked as to how the consumption of food as reported at a given income level would compare with what families would have eaten had all of them in the group fully adjusted their consumption to the income reported.

The assumption is commonly made that consumption and purchase of various goods lag behind change in income. If in a current survey any income class is heavily weighted with people whose incomes have recently increased, it may be that consumption is below what it would have been had the families on the average experienced this income for a longer period of time. The reverse of this condition may prevail if an income class is heavily weighted with families who until recently had a much higher income. The usual assumption is that the lag in consumption is greater when incomes are moving down than when they are moving up; in other words, the resistance to lowering consumption levels is greater than the hesitation in taking full advantage of increased incomes.

Only to a limited extent has this aspect of food consumption been explored and it should receive further attention. It does seem important to note that consumption and purchase of food tend to contract less with reduction in buying power than do the purchases of durable goods such as house furnishings; the use of these latter goods can be prolonged.

The bearing of year-to-year fluctuations in income along with the difficulty in separating capital investment from farm expenses in getting a measure of net money income has long been recognized as responsible in part for the very low income elasticity of demand for food found among many groups of farm families. The negative and very low positive income categories may include some well-to-do farm families who are classed as having low net money income, as a result of such farm expenses as the purchase of a tractor (or incurring a debt in order to acquire it). In this class also are farm families whose incomes are low because of recent crop failure. Consumption may be only slightly related to current income because such families may have large reserves on which to draw.

Year-to-year data from panels of farm families in midwest States show some of the dangers of interpreting current income as an indicator of the relation of income in general on consumption. In Kansas, for example, the correlation of average annual expenditures for food with current annual income for the years 1934 to 1941 was very low.4/ A higher correlation exists if the net income of the current and the preceding year were averaged. A still higher correlation was found with the gross income of the current and preceding year. These higher correlations are partly due to the fact that Kansas farm families receive their income irregularly--the larger portion of their annual income is received during the last six months of a calendar year.

Home-Produced Food

Home-produced food is usually important among farm families and introduces certain complications in dietary analysis. In most dietary surveys, the home-produced food is given a dollar value that is included along with the food purchased in the dollar value of foods consumed. This amount also is treated as nonmoney, and hence of total income. Since farm family diets are often classified by both total income and value of food consumed, the prices used to impute a value to the home-produced food have a bearing on the magnitude of various relationships derived from analysis. The prices used in valuing these foods may range from farm sale to retail. Various in-between prices may be selected. In the dietary surveys connected with the Consumer Purchases Study made during 1936-37 and Spending and Saving in Wartime during the spring of 1942, the prices used were those at the most likely place of purchase. These were somewhat less than retail prices since farm families in buying food get some of it from neighboring farms. In more recent studies a shift has been made to using farm sale prices. For the spring of 1942, the money value of home-produced food estimated at farm sale prices amounted to about 50 percent of that estimated by using purchase prices.

4/ This analysis is based on data in annual reports of accounts of Kansas farm families published by Kansas State College.

The selection of prices to use depends in part on the purpose the data are to serve. If there is an interest in making the purchasing power per dollar of farm family income as nearly like that of city family as possible, purchase rather than farm prices should be used to impute a value to home-produced foods. However, even when these are used, the purchasing power of dollars is still different and the consumption of such things as meat and milk by farm families is very high in relation to imputed prices. For many all-round economic analyses it is desirable to value food on the basis of the cost as seen by the family. For most foods this is the sale price which represents a measure of income foregone. To make farm-urban comparisons as to level of dietary adequacy achieved at a given level of real income, measures of relative costs of living are needed.

The importance of taking into account the prices used for imputation can be illustrated with data from the 1941 national dietary survey. At the net money income level of $1,000-$1,500, the value of total food consumed as a percentage of total income with two types of prices used for valuation is as follows:

Imputed prices	Total income	Value of food	Food as a percentage of income
Purchase.....	$1,783	$662	37 percent
Farm sale 1/...	1,600	479	30

1/ The value of home-produced food as reported in the U. S. Dept. of Agr. Misc. Pub. 520 was cut in two. This adjustment factor is based on a comparison of relative prices in U. S. Dept. of Agr. Misc. Pub. 550 that reports the data for a 7-day period in the spring of 1942 (42) (47).

Dietary Patterns

The data from family dietary surveys provide a fund of information on dietary patterns. These are of quite different types. There are, for example, menu patterns, such as are commonly secured as part of the family food record, which can be analyzed to show the frequency of various food combinations. Data on the percentage of families in a given region consuming specified foods during the week of the survey also tell much about the diet patterns. In addition, statistical measures of interrelations of the foods and the nutrients in the diets are also of interest. Preliminary examination of the data from food records of nonfarm families reporting in the Consumer Purchases Study suggest that the relation of nutrients and foods in family diets as well as their interrelations are linear.

Some exploratory analysis of this type has been done through the multiple correlation of calories and selected nutrients with 11 food groups. Such an analysis, in addition to providing correlation and partial regression coefficients of the various foods and nutrients in family diets provides a basis for developing food budgets within customary food habits. These can conform to selected levels of nutritive adequacy with or without regard to minimizing cost. Such analysis also provides a method of estimating the relative cost of food providing diets of specified nutritive quality for families of various types and among different types of communities.

FAMILY DIETARY SURVEYS IN RELATION TO NATIONAL FOOD SUPPLIES

Many uses for data from family dietary surveys have already been suggested in this chapter. An additional use is that of interpreting estimates of national food supplies and food requirements.

As one measure of food consumption, the U. S. Department of Agriculture periodically publishes estimates of yearly per capita consumption of various foods. These averages are derived from national aggregates of consumption based on statistics of production, foreign trade, inventories on hand, industrial uses, feed, seed, and estimates of losses in distribution between farm and kitchen. Calculations are made of the nutrient content of the per capita supplies available for direct human consumption. These data are especially useful for showing changes in consumption and for relating changes in the calculated nutrient content to shifts in consumption of different kinds of food or to some program such as the enrichment of flour and bread. Such an analysis covering a 37-year period was recently published (46).

Per capita averages include all the food that goes into institutions and public eating places as well as that which goes into the home, and pool the extremely good with the extremely poor in giving a single measure. The limitations of these data as a basis for judging the nutritional adequacy of national food supplies are obvious. For example, calcium is the only one of the 9 nutrients considered that during the 37-year period falls markedly below the recommended dietary allowances of the National Research Council. However, dietary surveys of housekeeping families show a very different picture. The Consumer Purchases Study in 1935-36 indicated inequitable distribution for many foods and nutrients. The following statement briefly summarizes its findings:

> "About three-fourths of the families in the United States had diets that did not meet the National Research Council's recommendations for riboflavin and about half had diets that were low in calcium, thiamine and ascorbic acid." (47)

Over-all national averages for 1942 indicate no deficiencies. Nevertheless from dietary surveys it is estimated that in the spring of 1942 the diets of more than half of the families failed to meet the recommended allowances for riboflavin although the proportion correspondingly low in calcium had been reduced to less than a third; and the proportion low in thiamine, to a fourth.(46)

National per capita averages nevertheless have value as indicators of relative adequacy. It seems highly probable that as national per capita averages of various nutrients change, all or almost all population groups are somewhat affected even though not equally. The per capita national averages are thus useful in indicating trends. If the distribution among population groups within various countries were about the same, and if the methods of calculation were comparable, national per capita averages would also be useful in indicating relative adequacy of diets among countries.

Figures on national per capita consumption combined with estimates of the quantities of different kinds of food needed to bring diets of poorly fed population groups up to some one or more recognized levels of nutritional adequacy also enable the nutritionist and food economist to indicate in quantitative terms the increases in consumption (and production) that might well contribute to improved national well-being. Such data as well as trends in consumption and analyses of market demand under varying assumptions of incomes and prices are basic in developing requirements for domestic production of and international trade in agricultural products.

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APPENDIX. SAMPLES OF SCHEDULES

I. FORMS FOR STUDYING FOOD INTAKE OF INDIVIDUALS

A. SCHEDULE USED FOR OBTAINING DIET RECORDS OF STUDENTS USED BY THE MILBANK MEMORIAL FUND, NEW YORK CITY.

N.S.9 PUPIL DIET RECORD Date _____ Taken by _____ Name _____ Record No. _____

	BREAKFAST		NOON MEAL		NIGHT MEAL	
	Description of Food	Amount	Description of Food	Amount	Description of Food	Amount
YESTERDAY						
DAY BEFORE YESTERDAY						

BETWEEN MEALS

Yesterday

Food _____ Am't

Food _____ Am't

Food _____ Am't

FOOD HABITS

Yesterday's lunch: Eaten at home____ Carried____ B'ght.____ At school____ Free____

Previous day's " : Eaten at home____ Carried____ B'ght.____ At school____ Free____

Do you usually eat about the same breakfast? _____

If not, explain _____

Do you usually eat about the same amount of food, as in the past 2 days? _____

Do you drink milk? _____ No. of glasses per week _____ Eggs per week _____

Kinds of fresh fruit eaten in past 7 days: _____

Vegetables in past 7 days: _____

Vitamin preparation: Kind _____ Brand _____ Am't. _____

ACTIVITIES

Hour arose this A.M. _____ Yesterday _____ Hr. to bed last night _____ Previous _____

School exercise periods: Yest. _____ Prev. _____

Outdoors: Yest. _____ Prev. _____

Work or chores: Yest. _____ Prev. _____

Reading or studying: Yest. _____ Prev. _____

Indoors: Movie, etc. Yest. _____ Prev. _____

Other: _____

USUAL ACTIVITIES

School clubs _____

Other clubs _____

Athletics _____

Dancing _____

Movies _____

Other _____

Pre Food _____ Am't. _____

Vitamin Preparation:

Kind _____

Brand _____

Am't. _____

B. SCHEDULES FOR OBTAINING DIET RECORDS OF PREGNANT WOMEN, VANDERBILT UNIVERSITY,

DAY OF WEEK — SCHOOL OF MEDICINE, NASHVILLE, TENNESSEE

DATE

MEAL	KIND OF FOOD	AMOUNT
BREAKFAST		
Between Breakfast and Dinner		
DINNER		
Between Dinner and Supper		
SUPPER		
Between Supper and Bedtime		

DIET RECORD DURING PREGNANCY

NAME _____ HISTORY NUMBER _____ W.P.

DATE _____ TO _____ TRIMESTER _____

Measuring Directions

Record all food eaten and all drinks except water. Judge the amounts as well as you can and fill in this record after each meal.

I. Bread - Tell number of pieces, kind and size. Such as: 2 small buttermilk biscuits, or, 1 piece of cornbread (with egg) 2 inches square and 1 inch thick.

II. Butter or Oleomargarine - Measure by level teaspoons or tablespoons.

III. Cereals - Judge by cups. Such as: 1 cup cornflakes or 1/3 cup of cooked oatmeal. Give amounts of sugar, milk, or cream used.

IV. Candy - Kind, size, a

V. Desserts - Judge amou
cake has icing. Giv

VI. Drinks - State whethe
drink, give name of

VII. Fruits - Tell size an
canned peaches. If

VIII. Meats - Tell kind, how it is cooked, and size of piece eaten. Tell amount of gravy eaten.

IX. Sandwiches - Tell kind of bread and what is in the sandwhich.

X. Soups and Stews - Give amounts and name ingredients.

XI. Vegetables - Tell kind and amount, judged by tablespoons or cupfuls after cooking, unless served raw. Give amounts of raw vegetables eaten and kind and amount of dressing used.

Individual instructions are given by a nutritionist before record is kept. Upon completion the record is discussed with the subject and additional information on recipes, sizes of servings, etc. is obtained.

Supplements:

C. SCHEDULES FOR OBTAINING DIET HISTORY AND DIET RECORD OF PREGNANT WOMEN, HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MASS.

PRENATAL NUTRITION HISTORY

✸ Form Prepared by Department of Maternal and Child Health, Harvard School of Public Health

Name_____ Study Number_____ Hospital Number_____ Date_____

Average Intake (amount and frequency)	Prev. to Preg.	First Trimester	Second Trimester	Third Trimester
Milk (all forms)				
Meat, Fish, Liver, Poultry				
Prepared Meats, etc.				
Eggs				
Fruit: Citrus, Tomatoes, etc.				
Fruit: Dried				
Fruit: Others				
Vegetables: Dk.Gr.Leafy or Deep Yellow				
Vegetables: Legumes				
Vegetables: Potato				
Vegetables: Others -				
Vegetables: Others -				
Cereals: Whole Grain				
Cereals: White				
Bread, Whole Grain or				
Macaroni, Rice, etc.				
Crackers				
Cookies				
Butter or Oleo				
Other Fats				
Nuts and Peanut Butte				
Puddings				
Pie				
Cake, Doughnuts, etc.				
Ice Cream				
Candy and Other Sweet				
Jam, Jelly, etc.				
Sugar				
Sirup				
Molasses				
Salt				
Soup				
Beverages: Tea and Co				
Beverages: Cocoa or C				
Beverages: Soft Drink				
Beverages: Beer, Wine				

Name_____ Hospital Number_____
Study Number_____ Date_____

Health Habits and Other Factors Relating to Nutrition

	Previous to Pregnancy	First Trimester	Second Trimester	Third Trimester
Meals/Day				
Appetite				
Food Dislikes				
Frequency Nausea Frequency Vomiting				
Vitamin Concentrates				
Other Nut. Concentrates				
Bowels: Regularity Laxative (Kind and Freq.)				
Sleep: Hours Sound or Disturbed				
Day Rest: Hours Sleep				
Outdoor Exercise				
Work: Kind Hours				
Cigarettes No./Day				
No. Persons Living in Family				
Income				
Number of Rooms				
Other Factors				

Food Intake (Pattern of eating previous to pregnancy and usual variations)

Breakfast __ a.m.		Noon Meal __ p.m.		Evening Meal __ p.m.	
	Am't		Am't		Am't

✸ Form used in cross checking information obtained by interview regarding food intake. Later, the amount of each food or food group which is most representative of the subject's average intake is used for computation of calories, proteins, 3 minerals, and 5 vitamins. Diet is then evaluated and rated.

Name_____ Weight _____ Date_____

Food Intake (Pattern of eating during_____)

Breakfast ___a.m.		Noon Meal ____p.m.		Evening Meal ___p.m.	
	Am't		Am't		Am't

Comments:

HARVARD SCHOOL OF PUBLIC HEALTH
HEALTH CONFERENCE
55 SHATTUCK STREET, BOSTON, MASSACHUSETTS

One Complete Day's Record of Food Eaten

Directions:

Orange juice or *fruit:* State number of oranges and size used.

Other fruit: State kind, number or size of serving (1 small sauce dish = ½ measuring cup, 4 rounding tbsps.* = ½ cup, 16 level tbsps. = 1 cup).

Cereal: State amount as rounding tbsps. or in terms of measuring cup.

Bread: State number of slices, and if purchased as sliced bread. If not, state thickness as ¼ or ½ inch or whatever it is.

Butter: Record as level tsps. (1 pat = 1 level tsp.†).

Egg: Check as to whether whole egg or yolk only.

Bacon: Number of slices — indicate whether long (full length) slices or ½ slices.

Milk: Amount on cereal — state in terms of measuring cup. If top milk or cream used, cross out milk. State cream light, medium, or heavy. Cup refers to measuring cup. *1 ordinary drinking glass = ¾ cup.* 1 tall glass (iced tea glass) — 1¼ cup. Where it states milk or cream, cross out one not used.

Sugar: Give as level tsps.

Other foods: Record as accurately as possible in ordinary household measures any foods eaten not listed.

Meat or Fish:
1 small serving meat or fish = 1 oz. = 2 tbsps.
1 average serving meat or fish = 3 oz.
1 large serving meat or fish = 4 oz.

Vegetables: Record in rounding tbsps.
(1 ordinary small saucer of vegetables = ½ cup = 4 rounding tbsps.)

Dessert:
Average serving = ½ cup.
Milk or sauce, etc., added should be recorded and amount stated.

* Tablespoon = tbsp. † Teaspoon = tsp.

Name ..... **Date** .....

Address .....

Read directions carefully before filling out the following:

Breakfast: **Time** ..... a.m.

Orange ..... Amount. Other fruit ..... Amount .....

Cereal — Kind ..... Amount .....

Bread — Kind ..... { No. slices ..... } Toasted { Yes / No }
{ Thickness ..... inch }

Butter — Amount ..... tsps.

Egg ..... No. whole egg or yolk. How cooked .....

Bacon ..... No. of slices. Sugar on cereal ..... tsps.

Milk ..... Amount on cereal. Milk to drink ..... cups

Cocoa ..... cups. Other beverage ..... cups

Is cocoa made with milk? ..... If not, what part milk? .....

Sugar in cocoa or other beverage ..... tsps.

Milk or cream added to cocoa or other beverage ..... tbsps.

Other foods eaten ..... Amounts .....
..... Amounts .....

Between Breakfast and Dinner

Foods eaten ..... Amounts .....
..... Amounts .....
..... Amounts .....

(Include ice cream, candy, sodas, etc.)

Time ..... a.m. Regular ..... Irregular .....

Dinner (Midday Meal) ..... **Hr.**

Soup ..... Kind. Amount .....

Meat, egg, fish or substitute ..... Kind. Amount .....

Potato — No. and size ..... How cooked .....

Skin eaten .....

Cooked vegetables ..... Kind. Size of serv. .....
..... Kind. Size of serv. .....

Raw vegetables ..... Kind. Size of serv. .....
..... Kind. Size of serv. .....

Bread: Kind ..... { No. slices ..... / Thickness ..... inch }

Amount of butter used on bread, potato, vegetables ..... tsps.

Amount of salad dressing and kind ..... tsps.

Amount of gravy ..... tbsps.

Milk: Amount ..... cups Other beverage ..... cups

Sugar in beverage ..... tsps. Cream or milk ..... tbsps.

Dessert: Kind ..... Size of serving .....

Other foods eaten ..... Amounts .....
..... Amounts .....
..... Amounts .....

Between Dinner and Supper

Foods eaten ..... Amounts .....
..... Amounts .....
..... Amounts .....

(Include ice cream, candy, sodas, etc.)

Time ..... p.m. Regular ..... Irregular .....

Supper (Evening Meal): **Time** ..... p.m.

Main Dish: Kind ..... Amount .....

Potato: No. and size ..... How cooked .....
Skin eaten .....

Vegetables: Cooked: Kind ..... Size of serv. .....
Raw: Kind ..... Size of serv. .....

Bread: Kind ..... { No. slices ..... / Thickness ..... inch }

Amount of butter used on bread, potato, vegetables, etc. ..... tsps.

Salad dressing: Kind ..... Amount .....

Gravy ..... tbsps.

Milk: Amount ..... cups Other beverage ..... cups

Sugar in beverage ..... tsps. Cream or milk ..... tbsps.

Dessert: Kind ..... Size serving .....

Other foods eaten ..... Amounts .....
..... Amounts .....

Between Supper and Bedtime

Foods eaten ..... Amount .....
..... Amount .....
..... Amount .....

(Include ice cream, candy, sodas, etc.)

Time ..... p.m. Regular ..... Irregular .....

Cod Liver Oil ..... tsps. No. times daily .....
or
Substitute ..... drops

Water: No. of glasses daily .....

Appetite, less than usual ..... usual
more than usual .....

Sickness or indisposition, specify .....

Remarks:

II. FORMS FOR STUDYING THE FOOD INTAKE OF FAMILIES

A. EXCERPTS OF A FOOD RECORD SCHEDULE, BUR. OF HUMAN NUTRITION AND HOME ECONOMICS, U.S. DEPT. OF AGRICULTURE, WASHINGTON, D.C.

A. Inventory of Food on Hand and Record of Food Brought into Home During Week

Food on hand.--The agent who visits your home will help you record what is on hand at the beginning of the week and again at the end. All staple foods stored in cabinet, cupboard, or pantry, or kept on dining room table or buffet and more perishable foods held in refrigerator, cold box, or cellar should be included. Any large supply of staple foods as potatoes, flour, home canned food, smoked meats, or frozen food in a storeroom, cellar or freezer locker separate from the kitchen, need not be entered on the inventory. Instead, supplies for current use can be entered when they are brought from storage into the kitchen.

Food brought in during the week.--List all foods brought into the kitchen before you put them away or use them. Include all food whether--Paid for or charged,
Carried or delivered,
Bought or from garden or storage (not inventory),
A gift or payment in food.
Before listing the food for a day, on the next free line in column 1, enter the day and date, as--Last day, October 14. If for any day no food is brought into the house, enter the day and date in column 1 and write "none" in column 2.

Inventory dates: Date of beginning inventory _____ after _____ meal
Date of closing inventory _____ after _____ meal

Food	Fresh, frozen, canned, dried, cured, ready-cooked	Bought, home-produced, other	Food on hand at beginning and food brought in day by day			Closing inventory		
			Number of units	Unit (Lb., qt.)	Price and unit of bought food	Number of units	Unit (Lb., qt.)	Price and unit of bought food
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1 Fat in salvage can								
2					$ for			$ for

B. Recipe Sheet

Enter a recipe for each food mixture prepared at home that is--(1) on hand at time of beginning inventory, (2) on hand at time of closing inventory, or (3) eaten during the week of the record by a child in the 3rd - 6th grade.

1. Recipe: (a) Name _____ (b) Dates eaten during week _____
2. For mixtures entered on either inventory, give proportion of total recipe on hand at time of:
   (a) Beginning inventory _____ (b) Closing inventory _____
3. For mixtures eaten by children in 3rd - 6th grades, give proportion of total recipe eaten during week by each child:
   Child No. 1 _____ Child No. 2 _____ Child No. 3 _____

Foods List all foods used in recipe except seasonings, spices, flavorings; exclude water	Fresh, frozen, canned, dried, cured, ready-cooked	Bought, home-produced, other	Quantity		Food mixtures on inventories Price and unit of bought food
			Number of units	Unit (Pt., cup, tbsp., tsp.)	
(1)	(2)	(3)	(4)	(5)	(6)
					$ for

C. Daily Menu from Family Food Supplies Day _____ Date _____

Menu. Enter all foods and mixed dishes made from family food supplies that were eaten at meals or between meals by any member of the household or guests (1)	Quantity in household measure of each food eaten by children in 3rd - 6th grade: Child No. ___ (2)	Child No. ___ (3)	Child No. ___ (4)
BREAKFAST			
NOON MEAL			
EVENING MEAL			
PACKED LUNCHES			
BETWEEN-MEAL S			

D. Use of Cooking Water

1 a. Do you use the water in which any vegetables are cooked? Yes ☐ No ☐

b. If Yes, which vegetables?

_____

_____

_____

E. Identifying Information

1 School: Col.St. East Side
2 Assignment no. _____
3 Agent _____
4 State _____
5 City _____
6 Reviewer _____
7 Dates covered _____

DO NOT FILL

8 _____
9 _____
10 _____
11 _____
12 _____

F. Daily Record of Persons Fed from Family Food Supplies

The agent who visits your home will help you fill in this page and enter the number of meals each person has from family food supplies day by day. Remember to tell the agent about packed lunches to be eaten at work, school, or picnics, and refreshments served to guests.

(1) Persons (Give relation to head of family)	(2) Age	(3) Sex	(4) Wt.	(5) Hgt.	(6) a. Adults--Activity code b. Children--Name of school	(7) Check meals from family food supplies: 1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
						1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
1													
2													
3													
4													
5													
6													
12													
Total													

G. Record of Food Eaten Away from Home by Members of Family

Tell the agent, day by day, about meals eaten away from home by family members. Do not include meals carried from home food supplies. Also report cost of meals and snacks away from home.

Meals, supplements to meals, snacks	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
1 Number of meals: At work								
2 At school								
3 Other meals out								
4 Total (1-3): All								
5 Purchased								
6 Expense for purchased food: Meals (in item 5)	$	$	$	$	$	$	$	$
7 Supplements								
8 Between-meal soft drinks, candy, etc.								
9 Alcoholic drinks (at bar, etc.)								
10 Total (6-9)	$	$	$	$	$	$	$	$

(8) Enter kind help (to b garbage; a

B. EXCERPTS OF A FOOD LIST SCHEDULE, BUR. OF HUMAN NUTRITION AND HOME ECONOMICS, U.S. DEPT. OF AGRICULTURE, WASHINGTON, D.C.

FOOD USED (Contd.) -2-

Food (a)	Fresh frozen canned dried cured ready-cooked (b)	Quantity used: Number of units (c)	Unit: Qt. lb. doz. cup etc. (d)	Code: B HP O (e)	Bought food: Price and unit (f)	DO NOT FILL: Codes: Source (g)	Group (h)	Food (i)	Quantity of food in pounds (j)	Expense for bought food (k)
FATS, OILS										
12. Butter										
13. Margarine										
14. Lard										
21. Beef: Steak, round: Bone in__ boned__										
22. Steak, other: Bone in__ boned__										
23. Roast, rib: Bone in__ boned__										
24. Roast, other: Bone in__ boned__										
25. Boiling, stewing, soup: Bone in__ boned__										
26. Corned beef__ chipped beef__										
27. Ground										
28. Veal: Roast: Bone in__ boned__										
29. Cutlets, chops: Bone in__ boned__										
46. Fish: Salmon__ tuna fish__ sardines__ mackerel__ herring__ Live__ drawn__ dressed__ steak sliced__ fillet__										
47. Other fish__ Live__ drawn__ dressed__ steak sliced__ fillet__										
48. Shellfish: Clams__ crabs__ lobster__ oysters__ scallops__ shrimp__ clam juice__ other__: In shell__ shelled__										
49. Mixtures, chiefly meat, poultry, fish: Beans with franks__ chicken noodle dinner__ chicken a la king__ chili con carne__ codfish cakes__ corned beef hash__ deviled crab__ meat stew__ ravioli__ spaghetti with meat balls__ tamales__ plate meal__ other__										
67. Spinach: Trimmed__ not trimmed__										
68. Turnip greens: With turnips__ no turnips__ Trimmed__ not trimmed__										
69. Beet tops: With beets__ no beets__ Brussel sprouts__ chard__ dandelion__ poke__ other greens__ Trimmed__ not trimmed__										
70. Asparagus: Green__ white__ Whole with butt end__ tips only__										
71. Beans, lima and butter (green): In pod__ shelled__										
72. Beans, snap: Green__ yellow__										
73. Soybeans (green): In pod__ shelled__										
74. Broccoli: Trimmed__ not trimmed__										
75. Cabbage: Green__ white__ red__ Chinese__										
76. Lettuce: Headed__ leaf__										
140. Corn meal: White: Whole ground__ degerminated__										
141. Yellow: Whole ground__ degerminated__										
142. Grits: Whole ground__ degerminated__										
143. Hominy (big): Dry__ ready cooked__										
144. Corn: Popping__ popped__										
145. Rice: White__ converted__ brown__										
146. Rolled oats, oatmeal										
147. Farina__ wheat cereal__ barley__ baby cereal__										

D. FOOD NOT EATEN BY HOUSEHOLD MEMBERS
that was included in the report just given

	Quantity: No. units	Unit
1. Fat:		
a. Fat in the drippings can:		
(1) How much fat was on hand? (a) At beginning of week		
(b) At end of week		
(2) How much fat was sold to the butcher during week?		
b. Fat not in the drippings can:		
(1) How much salt pork cooked with beans, greens and other vegetables was left not eaten on plates, serving dishes, and cooking utensils during week?		
(2) How much other fat meat and drippings was drained down the sink, lost through spoilage, given away, and used for soap during week? (a) Fat meat		
(b) Drippings		

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H. HOUSEHOLD COMPOSITION DURING LAST 7 DAYS AND 1947, NUMBER OF MEALS EATEN AT HOME AND EXPENSE FOR FOOD EATEN AWAY FROM HOME

Family members by relationship to head and other persons in household (1)	Sex (2)	Age (3)	Wt. (4)	Ht. (5)	Adults only activity code (6)	During last 7 days: Number of meals: Obtained from family food supplies (7)	Received as gift or pay (8)	Bought and eaten away from home (9)	Expense for food away from home: Meals (10)	Between meal food and drink; supplements to carried meals (11)
At time of interview:										
1. Family members:									$	$
2.										
7.										
8.										
9.										
10. Hired help, guests, etc:										
Others:										
11. Family members:			xx	xx	xx	x				
12.			xx	xx	xx	x				
13.			xx	xx	xx	x				
14. Hired help, guests, etc:			xx	xx	xx	x				
15. Total (1-14)	xx	xx	xx	xx	xx					
Roomers and boarders eating meals during last 7 days										
16.					xx					
17.					xx					
18.					xx					
19. Total (15-18)	xx	xx	xx	xx	xx					

I. INCOME: (/) Last week__ last month__

Family member no., Sec. I (use separate line for each job) (1)	Type of: Occupation (mechanic sales clerk, doctor) (2)	Place employed (steel mill bank, shoe store) (3)
1.		
2.		
3.		
8.		
9.		
10. Total (1-9)	xx	xx